REMARKS

Claims 1, 2, 4-6, 8-14, 23, 24 and 28-31 currently remain in the application. Claims 3, 7, 15-22 and 25-27 have been withdrawn and claims 1, 9, 10 and 28 are herein amended.

In response to the document entitled Amendment "G" After Final Action mailed December 7, 2009, the Examiner stated in said Advisory Action that the proposed amendment therein would not be entered because they raised new issues that would require further consideration and/or search. The present RCE is therefore being submitted to have such consideration and/or search to be effected. Thus, the claims section is herein amended in the same way presented in said Amendment "G" After Final Action, and applicant is herein presenting the same argument as before against the Examiner's rejection in said Final Action. For the convenience of the Examiner, applicant's argument presented in the REMARKS section of said Amendment "G" After Final Action is reproduced hereinbelow.

Claims 1, 2, 4-6, 8, 9, 11, 13, 23 and 28-31 were rejected under 35 U.S.C. 102 as being anticipated by Manabe, and claims 10, 12, 14 and 24 were rejected under 35 U.S.C. 103 over Manabe. In view of the cited reference and the reasons for the Examiner's rejection, independent claims 1, 9, 10 and 28 are herein amended, the amendment comprising adding a limitation regarding the direction of rotation of the liquid crystal molecules or, explained more in detail, regarding the function of the means for the restriction serving to restrict the direction of rotation of those of the molecules which are positioned near said wall surface but not anchored to said wall surface such that, when an electric field or a magnetic field is applied, the relative directions of motion with respect to the z-direction (defined as the axial direction of those of the liquid crystal molecules anchored to said wall surface and projected onto said wall surface) of end parts of said molecules rotating around their centers of gravity to move away from said wall surface will coincide with the bulk flow that is generated in said z-direction. This additional limitation is not only supported by the specification and hence believed enterable but also is believed to serve to overcome the Examiner's rejection for the reasons to be explained in what follows.

Explained in simplest terms, the present invention is characterized in that the direction of rotation of liquid crystal molecules is restricted such that the direction of a bulk flow of the liquid crystal to be generated can be specified, while Manabe is totally silent of the overall flow of liquid crystals, that is, Manabe says nothing of the relationship between the direction of their

overall flow (or their bulk flow) and the direction of rotations of the liquid crystal molecules. In other words, Manabe cannot predicate the rejection of the present application which discloses and is based upon the adjustment of the direction of rotations of liquid crystal molecules in order to generate a bulk flow in a specified direction.

The mechanism for generating a bulk flow in a specified direction by restraining the direction of rotations of liquid crystal molecules will be explained next for the completeness of the present response.

For the convenience of explanation, the z-direction will be defined, as shown in Fig. 1A on an attached sheet, as the axial direction of those of the liquid crystal molecule ① which is anchored to a wall surface (shown below), the positive z-direction being the direction in which the molecule ① is separating from the wall surface.

In the example shown in Fig. 1A, since the molecule ① points downward in the negative z-direction, the directions of rotation of those molecules ② positioned near the wall surface but not anchored thereto will be limited to the counter-clockwise direction when an electric field or a magnetic field is applied. In other words, if an electric or magnetic field is applied to the molecule ②, the relative direction of motion of the end part (shown by "a") of this molecule rotating so as to move away from the wall surface with respect to its center of gravity (shown by "g") is limited to the negative z-direction, as better shown in Fig. 2A.

Fig. 1A shows liquid crystal molecules disposed between a pair of wall surfaces so as to be movable in parallel motion (with the twist angle = 0°). As these molecules rotate, there results a flow of liquid crystal, giving rise to a speed distribution with local variations in speed and direction in motion between the pair of wall surfaces, but the direction of their overall flow or their bulk flow is determined by the difference between the quantity of liquid crystal molecules flowing in the negative z-direction (represented by area A1) and that of molecules flowing in the positive z-direction (represented by area A2).

Figs. 3A and 5A are respectively calculated and experimentally obtained distribution of speed in the z-direction as the twist angle is varied between 0° and 180°. As shown, the difference between A1 and A2 is zero when the twist angle is 0° but a difference appears as the twist angle is increased, A1 being always bigger than A2. In other words, whatever is twist angle (other than 0°), a bulk flow results in the negative z-direction as the liquid crystal

molecules rotate.

In summary, the restraining means according to the present invention is intended to serve to restrain the direction of motion in the z-direction of the end part ("a") of those molecules (②) positioned near the wall surface but not anchored thereto as an electric or magnetic field is applied thereto to coincide with the z-direction of the bulk flow to be generated.

Figs. 4A and 5A are respectively calculated and experimentally obtained distribution of speed in the x-direction (perpendicular to the z-direction or normal to the paper), indicating that a flow of liquid crystal results also in this direction if the twist angle is not 0°.

The flow direction of the liquid crystal is determined by the flow rates in the z-direction and the x-direction. This is to say that a flow can be generated in the direction within the range of ±90° from the positive z-direction by restraining the direction of rotation of the liquid crystal molecules and adjusting the twist angle of the liquid crystal.

As stated above, Manabe is totally oblivious to the bulk flow of the liquid crystal and hence it is believed that the present application is neither anticipated by nor obvious over Manabe. It is therefore believed that the application is now in condition for allowance and such an action at an early date is earnestly solicited.

Respectfully submitted,

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